• After reading this chapter, the student should be able to do the following: Define the key terms as listed.
• List, describe, and compare the body fluid compartments.
• Discuss active and passive transport processes and give two examples of each.
• Discuss the role of specific electrolytes in maintaining homeostasis.
• Describe the cause and effect of deficits and excesses of sodium, potassium, chloride, calcium, magnesium, phosphorus, and bicarbonate.
• Differentiate between the role of the buffers, lungs, and kidneys in maintenance of acid-base balance.
• Discuss the role of the nursing process for fluid, electrolyte, and acid-base balances.

Fluids (Water)

• Functions
  – Delivery of nutrients to the cells and carry waste products from the cells
  – Provides a medium in which chemical reactions, or metabolism, can occur within the cell
  – Acts as a lubricant for tissues
  – Assists in heat regulation via evaporation
**Fluids (Water)**

- Percentage of body weight that is water depends on several factors.
  - **Age**
    - Premature infant: 90%
    - Newborn: 70-80%
    - Twelve years to adult: 50-60%
    - Older adults: 45-55%

**Fluids (Water)**

- Amount of Fat
  - Fat contains relatively little water.
  - The female has proportionately more body fat than the male, which means that the female has less body fluid.

**Fluid Compartments**

- **Extracellular Fluid**
  - Between the cells or in the tissue
  - Accounts for approximately 27% of the fluid in the body
  - Examples: lymph, cerebrospinal fluid, and gastrointestinal secretions
• The normal daily loss of fluids must be met by the normal daily intake.
• Daily water intake and output is approximately 2 to 2.5 liters.
• Fluid leaves the body through the kidneys, lungs, skin, and GI tract.

Intake and Output

• Intake includes all fluids entering the body.
  – This also includes tube feedings and parenteral intake such as intravenous fluids, blood components, and total parenteral nutrition.
• Output includes all fluids leaving the body.
  – Examples are urine and vomitus.
  – Also included is drainage from surgical wounds.

Intake and Output

• The kidneys play an extremely important role in fluid balance.
  – Output of 1 to 2 L of urine per day.
• The kidneys must excrete a minimum of 30 ml/hr of urine to eliminate waste products form the body.
• Several methods are used by the body to move fluids, electrolytes and other solutes, or dissolved substances into and out of cells.
  – Passive Transport Processes
    • No cellular energy is required to move substances from a high concentration to a low concentration.
  – Active Transport Processes
    • Cellular energy is required to move substances from a low concentration to a high concentration.

Passive Transport

• Diffusion: Example is the lungs and exchange of gases in the alveoli
  – This is the movement of particles in all directions through a solution or gas.

Passive Transport

• Osmosis
  – This is the movement of water from an area of lower concentration to an area of higher concentration.
  – It equalizes the concentration of ions or molecules on both sides of the membrane.
  – The flow of water will continue until the number of ions or molecules on both sides are equal.
Passive Transport

- Filtration
  - A force behind filtration is called hydrostatic pressure, or the force pressing outward on a vessel wall.

Active Transport

- Requires energy
- Force that moves molecules into cells without regard for their positive or negative charge and against concentration factors that would prevent entry via diffusion
- Substances actively transported through the cell membrane include sodium, potassium, calcium, iron, hydrogen, amino acids, and glucose.

Active Transport

- Electrolytes
  - Electrolytes develop tiny electrical charges when they dissolve in water and break up into particles known as ions.
    - Cations have a positive charge.
    - Anions have negative charge.
  - A balance exists between the electrolytes; for each positively charged cation, there must be a negatively charged anion.
Active Transport

- Sodium
  - A cation
  - Most abundant electrolyte in the body
  - Normal level: 134 to 142 mEq/L
  - Functions of sodium: regulates water balance

- Potassium
  - Normal level is 3.5 to 5 mEq/L
  - Well-balanced diet usually provides adequate potassium; approximately 65 mEq is required each day.
  - The main route of potassium excretion is the kidneys.
  - The main function is regulation of water and electrolyte content within the cell.

- Potassium
  - Hypokalemia
    - Decrease in body's potassium to a level below 3.5 mEq/L
    - The major cause of loss is renal excretion.
    - Potassium can be depleted due to excessive GI losses from gastric suctioning or vomiting and the use of diuretics.
    - This can affect skeletal and cardiac function.
Active Transport

• Potassium
  – Hyperkalemia
    • Increase in the body’s serum potassium level above 5 mEq/L
    • The major cause of excess potassium is renal disease; severe tissue damage causes potassium to be released from the cell.
    • This can cause cardiac arrest.

Active Transport

• Chloride
  – An extracellular anion.
  – Normal level is 96 to 105 mEq/L.
  – The main route of excretion is the kidneys.

Active Transport

• Calcium
  – A positively charged ion.
  – Normal level is 4.5 mEq/L.
  – Of calcium in the body, 99% is concentrated in the bones and teeth.
  – Vitamin D, calcitonin, and parathyroid hormone are necessary for absorption and utilization of calcium.
  – The best food sources are milk and cheese.
Figure 22-4, A & B


Acid-Base Balance
- Acid-base balance means homeostasis of the hydrogen ion concentration in the body fluids.

Slide show over
- Time to get something to eat!